

|   | Type | L # | Hits | Search Text   | DBs  | Time Stamp          |
|---|------|-----|------|---|--|---------------------|
| 1 | BRS  | L1  | 10   | (josephson adj junction)<br>and mesoscopic                              | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T;<br>IBM_TD<br>B | 2002/05/07<br>09:41 |
| 2 | BRS  | L2  | 4    | (josephson adj junction)<br>and (single adj electron<br>adj transistor) | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T;<br>IBM_TD<br>B | 2002/05/07<br>09:42 |

3/9/11 (Item 11 from file: 2)

DIALOG(R)File 2:INSPEC

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6256746 INSPEC Abstract Number: A1999-13-7450-011, B1999-07-3240C-005, C1999-07-4270-001

**Title: Environmentally decoupled sds-wave Josephson junctions for quantum computing**

Author(s): Ioffe, L.B.; Geshkenbein, V.E.; Feigel'man, M.V.; Fauchere, A.L.; Blatter, G.

Author Affiliation: Dept. of Phys. & Astron., Rutgers Univ., Piscataway, NJ, USA

Journal: Nature vol.398, no.6729 p.679-81

Publisher: Macmillan Magazines,

Publication Date: 22 April 1999 Country of Publication: UK

CODEN: NATUAS ISSN: 0028-0836

SICI: 0028-0836(19990422)398:6729L:679:EDWJ;1-V

Material Identity Number: N003-1999-017

U.S. Copyright Clearance Center Code: 0028-0836/99/\$12.00+2.00

Language: English Document Type: Journal Paper (JP)

Treatment: Practical (P); Theoretical (T)

Abstract: Quantum computers have the potential to outperform their classical counterparts in a qualitative manner, as demonstrated by algorithms which exploit the parallelism inherent in the time evolution of a quantum state. In quantum computers, the information is stored in arrays of quantum two-level systems (qubits), proposals for which include utilizing trapped atoms and photons, magnetic moments in molecules and various solid-state implementations, but the physical realization of qubits is challenging because useful quantum computers must overcome two conflicting difficulties: the computer must be scalable and controllable, yet remain almost completely detached from the environment during operation, in order to maximize the phase coherence time. We report a concept for a solid-state "quiet" **qubit** that can be efficiently decoupled from the environment. It is based on macroscopic quantum coherent states in a superconducting quantum interference loop. Our two-level system is naturally bistable, requiring no external bias: the two basis states are characterized by different macroscopic phase drops across a **Josephson junction**, which may be switched with minimal external contact. (21 Refs)

Subfile: A B C

Descriptors: Josephson effect; quantum computing; SQUIDS

Identifiers: environmentally decoupled sds-wave Josephson junctions; quantum computers; parallel algorithms; quantum state time evolution; quantum two-level system arrays; solid-state quiet **qubit**; trapped atoms; photons; molecular magnetic moments; solid-state implementations; scalable computers; controllable computers; phase coherence time; macroscopic quantum coherent states; superconducting quantum interference loop; SQUID loop; bistable system; basis states; macroscopic phase drops; phase switching; external contact

Class Codes: A7450 (Superconductor tunnelling phenomena, proximity effects, and Josephson effect); A0365 (Quantum theory; quantum mechanics); B3240C (Superconducting junction devices); C4270 (Quantum computing theory)

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3/9/29 (Item 10 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
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07650149 Genuine Article#: 192BL Number of References: 18

**Title: Coherent control of macroscopic quantum states in a single-Cooper-pair box**

Author(s): Nakamura Y (REPRINT) ; Pashkin YA; Tsai JS

Corporate Source: NEC FUNDAMENTAL RES LABS, /IBARAKI/OSAKA 3058051/JAPAN/  
(REPRINT); JAPAN SCI & TECHNOL CORP, CREST/KAWAGUCHI/SAITAMA  
3320012/JAPAN/

Journal: NATURE, 1999, V398, N6730 (APR 29), P786-788

ISSN: 0028-0836 Publication date: 19990429

Publisher: MACMILLAN MAGAZINES LTD, PORTERS SOUTH, 4 CRINAN ST, LONDON N1  
9XW, ENGLAND

Language: English Document Type: ARTICLE

Geographic Location: JAPAN

Subfile: CC PHYS--Current Contents, Physical, Chemical & Earth Sciences; CC  
LIFE--Current Contents, Life Sciences; CC AGRI--Current Contents,  
Agriculture, Biology & Environmental Sciences

Journal Subject Category: MULTIDISCIPLINARY SCIENCES

Abstract: A nanometre-scale superconducting electrode connected to a reservoir via a **Josephson junction** constitutes an artificial two-level electronic system: a single-Cooper-pair box. The two levels consist of charge states (differing by  $2e$ , where  $e$  is the electronic charge) that are coupled by tunnelling of Cooper pairs through the junction. Although the two-level system is macroscopic, containing a large number of electrons, the two charge states can be coherently superposed(1-4). The Cooper-pair box has therefore been suggested(5-7) as a candidate for a quantum bit or '**qubit**'-the basic component of a quantum computer. Here we report the observation of quantum oscillations in a single-Cooper-pair box. By applying a short voltage pulse via a gate electrode, we can control the coherent quantum state evolution: the pulse modifies the energies of the two charge states nonadiabatically, bringing them into resonance. The resulting state-a superposition of the two charge states-is detected by a tunnelling current through a probe junction. Our results demonstrate electrical coherent control of a **qubit** in a solid-state electronic device.

3/9/16 (Item 4 from file: 8)  
DIALOG(R) File 8: Ei Compendex(R)  
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05590410 E.I. No: EIP00065223235

**Title:** Josephson junction based quantum computing

**Author:** Makhlin, Yuriy; Schoen, Gerd; Shnirman, Alexander

**Corporate Source:** Universitaet Karlsruhe, Karlsruhe, Ger

**Source:** Applicable Algebra in Engineering, Communications and Computing v  
10 n 4 2000. p 375-382

**Publication Year:** 2000

**CODEN:** AAECEW **ISSN:** 0938-1279

**Language:** English

**Document Type:** JA; (Journal Article) **Treatment:** T; (Theoretical)

**Journal Announcement:** 0008W1

**Abstract:** Among the physical realizations of the elements required for quantum computation nano-scale electronic devices left bracket 2, 10, 12, 16 right bracket are very promising. They can be easily integrated into electronic circuits and scaled up to large numbers of qubits. Here we describe qubits based on low-capacitance Josephson junctions. In these systems Coulomb blockade effects allow the control of the charge on a superconducting island. They constitute quantum bits, with logical states differing by the charge on one island. Single- and two-bit operations can be performed by manipulating applied gate voltages. The phase coherence time is sufficiently long to allow a series of these steps. In addition to the manipulation of qubits, the resulting quantum state can be read out by coupling a single-electron transistor capacitively to the **qubit**. (Author abstract) 17 Refs.

**Descriptors:** Quantum theory; **Josephson junction** devices; Transistors

**Identifiers:** Quantum computing; Single electron transistors

**Classification Codes:**

931.4 (Quantum Theory); 704.2 (Electric Equipment); 714.2  
(Semiconductor Devices & Integrated Circuits)

931 (Applied Physics); 704 (Electric Components & Equipment); 714  
(Electronic Components)

93 (ENGINEERING PHYSICS); 70 (ELECTRICAL ENGINEERING); 71 (ELECTRONICS  
& COMMUNICATIONS)

3/9/5 (Item 5 from file: 2)  
DIALOG(R)File 2:INSPEC  
(c) 2001 Institution of Electrical Engineers. All rts. reserv.

6620988 INSPEC Abstract Number: B2000-07-3240C-039, C2000-07-5110E-001

**Title:** Josephson junction based quantum computing

Author(s): Makhlin, Y.; Schon, G.; Shnirman, A.

Author Affiliation: Inst. fur Theor. Festkorperphysik, Karlsruhe Univ., Germany

Journal: Applicable Algebra in Engineering, Communication and Computing  
vol.10, no.4-5 p.375-82

Publisher: Springer-Verlag,

Publication Date: 2000 Country of Publication: Germany

CODEN: AAEECW ISSN: 0938-1279

SICI: 0938-1279(2000)10:4/5L:375:JJBQ;1-J

Material Identity Number: 0519-2000-003

Language: English Document Type: Journal Paper (JP)

Treatment: Practical (P)

Abstract: Among the physical realizations of the elements required for quantum computation nano-scale electronic devices are very promising. They can be easily integrated into electronic circuits and scaled up to large numbers of qubits. Here we describe qubits based on low-capacitance Josephson junctions. In these systems Coulomb blockade effects allow the control of the charge on a superconducting island. They constitute quantum bits, with logical states differing by the charge on one island. Single- and two-bit operations can be performed by manipulating applied gate voltages. The phase coherence time is sufficiently long to allow a series of these steps. In addition to the manipulation of qubits, the resulting quantum state can be read out by coupling a single-electron transistor capacitively to the **qubit**. (17 Refs)

Subfile: B C

Descriptors: quantum gates; superconducting junction devices

Identifiers: quantum computing; nano-scale electronic devices; qubits; Josephson junctions; Coulomb blockade effects; quantum bits; **Josephson junction**; single-electron transistor

Class Codes: B3240C (Superconducting junction devices); B1265B (Logic circuits); C5110E (Other logic elements); C4270 (Quantum computing theory)

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3/9/21 (Item 2 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
(c) 2001 Inst for Sci Info. All rts. reserv.

09426740 Genuine Article#: 402TD Number of References: 22

**Title: Nanoscale superconducting quantum bits**

Author(s): Makhlin Y (REPRINT) ; Schon G; Shnirman A

Corporate Source: Univ Karlsruhe,Inst Theoret Festkorperphys,Kaiserstr  
12/D-76128 Karlsruhe//Germany/ (REPRINT); Univ Karlsruhe,Inst Theoret  
Festkorperphys,D-76128 Karlsruhe//Germany/; LD Landau Theoret Phys  
Inst,Moscow 117940//Russia/; Forschungszentrum Karlsruhe,Inst  
Nanotechnol,D-76021 Karlsruhe//Germany/

Journal: PHYSICA C, 2001, V350, N3-4 (FEB 15), P161-165

ISSN: 0921-4534 Publication date: 20010215

Publisher: ELSEVIER SCIENCE BV, PO BOX 211, 1000 AE AMSTERDAM, NETHERLANDS

Language: English Document Type: ARTICLE

Geographic Location: Germany; Russia

Journal Subject Category: PHYSICS, APPLIED

Abstract: Various physical systems were proposed for quantum information processing. Among those nanoscale devices appear most promising for integration in electronic circuits and large-scale applications. We discuss **Josephson junction** circuits in two regimes where they can be used for quantum computing. These systems combine intrinsic coherence of the superconducting state with control possibilities of single-charge circuits. In the regime where the typical charging energy dominates over the Josephson coupling, the low-temperature dynamics is limited to two states differing by a Cooper-pair charge on a superconducting island. In the opposite regime of prevailing Josephson energy, the phase (or flux) degree of freedom can be used to store and process quantum information. Under suitable conditions the system reduces to two states with different flux configurations. Several qubits can be joined together into a register. The quantum state of a **qubit** register can be manipulated by voltage and magnetic field pulses. The qubits are inevitably coupled to the environment. However, estimates of the phase coherence time show that many elementary quantum logic operations can be performed before the phase coherence is lost. In addition to manipulations, the final state of the qubits has to be read out. This quantum measurement process can be accomplished using a single-electron transistor for charge Josephson qubits, and a d.c.-SQUID for flux qubits. Recent successful experiments with superconducting qubits demonstrate for the first time quantum coherence in macroscopic systems. (C) 2001 Elsevier Science B.V. All rights reserved.

Descriptors--Author Keywords: Josephson junctions ; quantum computation ; quantum measurement

Identifiers--KeyWord Plus(R): SINGLE-ELECTRON TRANSISTOR;  
JOSEPHSON-JUNCTIONS; COMPUTATION

3/9/13 (Item 1 from file: 8)  
DIALOG(R) File 8: Ei Compendex(R)  
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05732953 E.I. No: EIP00125434765

**Title: Optical coherent control in materials with stripe phase**

Author: Alam, S.; Rahman, M.O.

Corporate Source: Electrotechnical Lab, Ibaraki, Jpn

Conference Title: Challenges in Process Integration and Device Technology

Conference Location: Santa Clara, CA, USA Conference Date:

20000918-20000919

Sponsor: SPIE-The International Society for Optical Engineering

E.I. Conference No.: 57696

Source: Proceedings of SPIE - The International Society for Optical  
Engineering v 4181 2000. Society of Photo-Optical Instrumentation  
Engineers, Bellingham, WA, USA. p 125-132

Publication Year: 2000

CODEN: PSISDG ISSN: 0277-786X

Language: English

Document Type: CA; (Conference Article) Treatment: T; (Theoretical); X;  
(Experimental)

Journal Announcement: 0101W4

Abstract: The possibility of using nano-stripes as an alternative to  
quantum dots as a candidate in the construction of quantum bit or **qubit**  
is discussed. The possibility of the coherent optical control of  
nanofabricated quantum system is also presented. A proposed system by  
Nakamura et al which is a nanometer-scale superconducting electrode  
connected to a reservoir via a **Josephson junction** is examined. 7 Refs.

Descriptors: **Josephson junction** devices; Nanostructured materials;  
Coherent light; Electrodes; Semiconductor quantum dots; Quantum theory

Identifiers: Quantum stripe

Classification Codes:

708.3 (Superconducting Materials); 933.1 (Crystalline Solids); 741.1  
(Light/Optics); 704.1 (Electric Components); 714.2 (Semiconductor Devices  
& Integrated Circuits); 931.4 (Quantum Theory)

708 (Electric & Magnetic Materials); 933 (Solid State Physics); 741  
(Optics & Optical Devices); 704 (Electric Components & Equipment); 714  
(Electronic Components); 931 (Applied Physics)

70 (ELECTRICAL ENGINEERING); 93 (ENGINEERING PHYSICS); 74 (OPTICAL  
TECHNOLOGY); 71 (ELECTRONICS & COMMUNICATIONS)

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3/9/28 (Item 9 from file: 34)  
DIALOG(R) File 34:SciSearch(R) Cited Ref Sci  
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Q (LAC) P74

C7755505 Genuine Article#: 204MC Number of References: 416

**Title:** Qubit devices and the issue of quantum decoherence

**Author(s):** Brandt HE

**Corporate Source:** USA, RES LAB/ADELPHI//MD/20783

**Journal:** PROGRESS IN QUANTUM ELECTRONICS, 1998, V22, N5-6, P257-370

**ISSN:** 0079-6727 **Publication date:** 19980000

**Publisher:** PERGAMON-ELSEVIER SCIENCE LTD, THE BOULEVARD, LANGFORD LANE,  
KIDLINGTON, OXFORD OX5 1GB, ENGLAND

**Language:** English **Document Type:** REVIEW

**Geographic Location:** USA

**Journal Subject Category:** ENGINEERING, ELECTRICAL & ELECTRONIC

**Abstract:** The exciting new field of quantum information science and technology is burgeoning with revolutionary new advances in the areas of quantum communication, quantum information processing, quantum computing, and quantum cryptography. Potential useful products of these advances include a wide variety of innovative **qubit** devices, ranging from quantum games and quantum teleporters to quantum computers and quantum robots. The major obstacle to the successful development of these devices is the phenomenon of quantum decoherence. This brief survey article gives reviews of a full gamut of potential **qubit** devices, alternating with expository discussions of the issue of quantum decoherence as it relates to the possible practical development of these devices. The **qubit** devices examined here include an interaction-free detector, a quantum key receiver, quantum games, various quantum gates, **qubit** entanglers, quantum dense coders, Bell-state analyzers, entanglement swappers, quantum teleporters, quantum repeaters, entangled atomic clocks, quantum copiers, various quantum computers, and quantum robots. (C) 1999 Elsevier Science Ltd. All rights reserved.

**Identifiers--KeyWord Plus(R):** NUCLEAR-MAGNETIC-RESONANCE; ERROR-CORRECTING CODES; JOSEPHSON -JUNCTION ARRAYS; NONCLASSICAL MOTIONAL STATES; PODOLSKY-POSEN CHANNELS; TRAPPED ATOMIC IONS; COLD CESIUM ATOMS; OPTICAL LATTICES; SINGLE-ELECTRON; NOISY CHANNELS



6715939 INSPEC Abstract Number: B2000-11-1265B-029, C2000-11-5110E-001

**Title: Nano-electronic circuits as quantum bits**

Author(s): Makhlin, Y.; Schon, G.; Shnirman, A.

Author Affiliation: Inst. fur Theor. Festkorperphys., Karlsruhe Univ., Germany

Conference Title: 2000 IEEE International Symposium on Circuits and Systems. Emerging Technologies for the 21st Century. Proceedings (IEEE Cat No. 00CH36353) Part vol.2 p.241-4 vol.2

Publisher: Presses Polytech. Univ. Romandes, Lausanne, Switzerland

Publication Date: 2000 Country of Publication: Switzerland 5 vol. (viii+813+768+769+768+760) pp.

ISBN: 0 7803 5482 6 Material Identity Number: XX-2000-01653

U.S. Copyright Clearance Center Code: 0 7803 5482 6/2000/\$10.00

Conference Title: ISCAS 2000 Geneva. 2000 IEEE International Symposium on Circuits and Systems. Emerging Technologies for the 21st Century. Proceedings

Conference Sponsor: IEEE Circuits & Syst. Soc

Conference Date: 28-31 May 2000 Conference Location: Geneva, Switzerland

Language: English Document Type: Conference Paper (PA)

Treatment: Practical (P); Theoretical (T); Experimental (X)

Abstract: Quantum information processing systems can be used in a variety of applications. Among proposed realizations of quantum bits nano-electronic circuits appear most promising for integration in electronic circuits and large-scale applications. We discuss **Josephson junction** circuits in two regimes where they can be used for quantum computing. In one limit, two logic states of the quantum bit differ by a Cooper pair charge,  $2e$ , on a superconducting island. In the other limit different magnetic fluxes penetrate a superconducting loop in two states. Single-**qubit** and two-**qubit** logic operations can be performed by means of voltage or current pulses. Weak coupling to the environment allows a series of these elementary steps before the phase coherence is lost. To read out the result of the computation a quantum measurement is needed. For charge qubits this can be accomplished by coupling a single-electron transistor (SET) capacitively to the **qubit**. Monitoring the current in the transistor one can extract the information about the state of the **qubit**. We discuss recent experiments and present a suitable set of circuit parameters available with the present-day technology. (14 Refs)

Subfile: B C

Descriptors: Cooper pairs; nanotechnology; quantum computing; single electron transistors; superconducting logic circuits

Identifiers: nano-electronic circuits; quantum bits; quantum information processing systems; **Josephson junction** circuits; quantum computing; logic states; Cooper pair charge; superconducting island; superconducting loop; single-**qubit** logic operations; two-**qubit** logic operations; phase coherence; single-electron transistor; circuit parameters

Class Codes: B1265B (Logic circuits); B3240C (Superconducting junction devices); B2560X (Quantum interference devices); C5110E (Other logic elements); C4270 (Quantum computing theory); C5120 (Logic and switching circuits)

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